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How Mood and Task Complexity Affect Children's Recognition of Others' Emotions

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Abstract

Previous studies examined how mood affects children's accuracy in matching emotional expressions and labels (label-based tasks). This study was the first to assess how induced mood (positive, neutral, or negative) influenced 5- to 8-year-olds' accuracy and reaction time using both context-based tasks, which required inferring a character's emotion from a vignette, and label-based tasks. Both tasks required choosing one of four facial expressions to respond. Children responded more accurately to label-based questions relative to context-based questions at 5 to 7 years of age, but showed no differences at 8 years of age, and when the emotional expression being identified was happiness, sadness, or surprise, but not disgust. For the context-based questions, children were more accurate at inferring sad and disgusted emotions compared to happy and surprised emotions. Induced positive mood facilitated 5-year-olds' processing (decreased reaction time) in both tasks compared to induced negative and neutral moods. Results demonstrate how task type and children's mood influence children's emotion processing at different ages.

Keywords

mood; children; social information processing; emotion recognition

Interpreting the emotional meaning in facial expressions can provide information concerning others' motives and intentions, and may guide one's behavior during social interactions (Ekman, 1992, 1993; Elfенbein & Ambady, 2002b; Schultheiss, Pang, Torges, Wirth, & Treynor, 2005). The ability to deduce the emotional expressions of others is an essential skill in the development of children's emotional and social competence (Saarni, 1990; Saarni, Campos, Camras, & Witherington, 2006). A substantial amount of research has examined factors influencing children's ability to match an emotion label to a facial expression (e.g., Bullock & Russell, 1984; Camras & Allison, 1985; Felleman, Carlson, Barden, Rosenberg, & Masters, 1983). In real-world situations, however, children are often not provided an emotional label and need to infer how someone is feeling. Children's ability to infer others' emotions is a skill that develops as early as the preschool years, but it is a skill that continues to refine with age (Gnepp & Gould, 1985). Furthermore, children's own feelings may impact emotion processing, but no studies have examined how children's mood influences their emotion recognition accuracy for tasks requiring emotion inference. The purpose of this study was to examine how induced positive, negative, or neutral mood influenced children's ability to infer a person's emotional expression after hearing a vignette about the person (context-based task). We also included label-based tasks to compare results

between the two types of tasks. Children tend to perform better on tasks that require them to match an emotional expression to a label as compared to matching an emotional expression to a situation, suggesting that label-based tasks are less complex than context-based tasks (Morgan, Izard, & King, 2010).

Factors Influencing Children's Recognition of Others' Emotions

As children get older, their emotion recognition accuracy typically improves (Chung & Thomson, 1995; Ekman, 1992, 1993; Gross & Ballif, 1991; MacDonald, Kirkpatrick, & Sullivan, 1996). Accuracy, however, does not reach adult-like levels until sometime between the ages of 7 and 14 years (Mondloch, Geldart, Maurer, & Le Grand, 2003). Emotional processing speed also does not become adult-like until 13 to 15 years of age (Batty & Taylor, 2006). These changes likely occur because children gain experience from social interactions (Tonks, Williams, Frampton, Yates, & Slater, 2007). As children age, they become more concerned with how others view them within social interactions and they also start to develop better expressive language skills (Turkstra, 2000). Compared to younger children (i.e., 5-6-year-olds), older children (i.e., 8-9-year-olds) and adolescents may be more proficient at understanding what an emotional expression means because they have a more sophisticated understanding for how emotional expressions are used during social interactions.

In addition to developmental changes, factors such as the type of emotional expression may influence emotion recognition accuracy. Children's recognition accuracy of happy and sad expressions is typically higher compared to other facial expressions (Boyatzis, Chazan, & Ting, 1993; Bullock & Russell, 1984; Camras & Allison, 1985; Felleman et al., 1983). Children's recognition accuracy of surprised and disgusted expressions, on the other hand, typically shows varying levels of accuracy (Boyatzis et al., 1993; Bullock & Russell, 1984; Camras & Allison, 1985; Gross & Ballif, 1991).

Influence of Emotional States on Cognition

Research studies that investigated the relationship between different emotion states and cognition have predominately involved adult participants. In regard to performance on categorization tasks, positive affect enabled participants to process pleasant information (e.g., list of positive personality characteristics of a target person) more readily and proficiently, whereas negative affect facilitated participants' processing of unpleasant material (e.g., list of negative personality characteristics of a target person), which is a principle known as the mood congruency effect (Bower, 1981; Forgas & Bower, 1987; Herr, Page, Pfeiffer, & Davis, 2012). Adults in a positive mood also categorized positive words (i.e., happy) faster than those in a negative mood; adults in a negative mood categorized negative words (i.e., sad) faster than those in a positive mood (Niedenthal, Halberstadt, & Setterlund, 1997).

In regard to performance on a memory recall task, positive mood increased participants' performance (Potts, Morse, Felleman, & Masters, 1986), whereas negative mood decreased participants' performance (Leight & Ellis, 1981). When engaging in a creativity task, some studies showed that positive mood facilitated cognitive performance by increasing participants' creativity (Ashby, Isen, & Turken, 1999; Isen, 2002; Isen, Daubman, & Nowicki, 1987), whereas other studies showed that positive mood resulted in inattentive processing, thereby reducing participants' creativity and problem-solving (Forgas, 2000; Kaufmann & Vosburg, 1997).

For tasks that assessed participants' learning, memory, and behavior, positive mood enhanced overall performance, perhaps because it helped individuals to see relatedness

among cognitions, thereby facilitating the sorting and integration of new information (Isen & Daubman, 1984). Negative mood, on the other hand, interfered with task-relevant processing, perhaps because it reduced a person's cognitive capacity to effectively engage in the task (Ellis, Thomas, & Rodriguez, 1984). Other studies showed that positive mood decreased participants' motivation and capacity to process information, perhaps because participants wanted to enjoy their positive mood state (Mackie & Worth, 1989), whereas negative mood enhanced participant's retrieval accuracy of information (Storbeck & Clore, 2005).

The divergence in findings concerning the relationship between affect and cognition may be explained by differences seen in the level of activation for the emotions used in these studies (De Dreu, Baas, & Nijstad, 2008). Some emotions may be deactivating, which decrease levels of arousal (e.g., calm, relaxed); other emotions may be activating, which increase levels of arousal (e.g., happy, elated) (De Dreu et al., 2008). Levels of activation may interact with the valence of an emotion. For example, certain positive mood states that are activating (i.e., happiness) are linked to increased levels of creativity, whereas certain negative mood states that are deactivating (i.e., sadness) are not linked to creativity (Baas, De Dreu, & Nijstad, 2008). Additionally, the differences in results may be due to the differences seen in the cognitive tasks participants are asked to complete. For tasks that require the use of flexible thinking and creativity, positive mood may result in increased performance accuracy (Isen et al., 1987), whereas for tasks that require high levels of concentration (e.g., memory recall tasks), a negative mood may be more beneficial (Storbeck & Clore, 2005). The notion that positive and negative affect are adaptive to different types of cognitive tasks is important because it may help to predict participants' performance for emotion recognition tasks that require divergent levels of flexible thinking and complexity.

Affect and Children's Recognition of Others' Emotions

Although there is a wealth of research investigating the relationship between affect and cognition, research examining how affect influences children's ability to recognize others' emotions is extremely limited (e.g., Carlson, Felleman, & Masters, 1983; Murray, 1933). Experimenters induced emotions, such as happiness, sadness, anger, or neutral affect, in 4 and 5 year-old children by having them focus on a particular emotion (e.g., sad) for 30 s (Carlson et al., 1983). Children then labeled emotional expressions (e.g., happy, sad, angry or neutral) from a group of black and white photographs of other children displaying these emotions. There were no significant differences in accuracy across the mood induction conditions, but when children in the sad condition were inaccurate, they typically identified sad peers as being angry. Additionally, children in the happy condition identified others' emotions faster than children in the other mood conditions (Carlson et al., 1983). Results indicated that children's own emotion can influence how quickly they process emotions in label-based tasks, but these findings may not generalize to real-world situations where clear emotional descriptors are infrequently provided during actual social interactions. Context-based tasks in which children need to infer the emotion from an emotionally charged situation may be more ecologically valid.

Children's Emotional Knowledge: Label-Based and Context-Based Tasks

For label-based and context-based questions, each relies on a different component of children's emotion knowledge. A label-based task relies on children's expressive knowledge of emotions (i.e., their ability to attach a word to a specific facial expression), a skill that emerges as early as 18-months of age (Denham, 2003). A context-based task relies on children's emotion situation knowledge (i.e., an understanding for why a specific emotional

expression is present), a skill that does not emerge until their preschool years and continues to refine into middle childhood (Brody & Harrison, 1987; Denham & Couchoud, 1990).

When children's performance on these two types of tasks are compared, children aged 3- to 6-years perform more accurately on tasks when they are asked to match an emotional expression to an emotional label compared to when they are asked to match emotional expressions with situations or causes (Morgan et al., 2010). These results are not surprising given that context-based tasks likely require more steps to solve than label-based tasks. Context-based tasks involve deducing how the person is feeling based on the story information and likely require recalling relevant past experiences to determine the emotion. Once children infer the emotion, children need to match that emotion with the correct facial expression. With a labeling task, however, the emotion label is clearly provided; individuals need only to match the label to the expression.

The Present Study

Given how positive mood facilitates cognitive processing for tasks that require flexible thinking, we investigated whether positive mood might improve children's accuracy and speed of processing during context-based tasks. We also included label-based tasks to compare our results to the context-based tasks and Carlson et al.'s (1983) results. For the present study, context-based tasks were considered more challenging and cognitively complex for children compared to label-based tasks.

To determine how mood and task complexity influence children's emotion recognition, children were randomly assigned to one of three mood conditions during which the experimenter induced positive, negative, or neutral affect. Children in the neutral mood condition served as a control. Five- to 8-year-olds identified a facial expression from one of four faces that matched an emotion label (label-based) or an emotion they inferred after hearing a short vignette (context-based). This age group participated because there are dramatic improvements in children's ability to infer others' emotions during these years (Gnepp, 1983; Gnepp, & Gould, 1985; Saarni et al., 2006; Thompson, 1987).

Based on related research (e.g., Baumann & Kuhl, 2005; Bower, 1981; Bryan, Mathur, & Sullivan, 1996; Carlson et al., 1983; Leight & Ellis, 1981; Morgan et al., 2010; MacDonald et al., 1996), we made the following predictions: 1) Children should more quickly and accurately recognize emotions in the label-based questions as compared to the context-based questions, regardless of mood condition; 2) The 7- to 8-year-olds should respond more quickly and accurately than the 5- to 6-year-olds; 3) Compared to children in the negative mood condition, children in the positive mood condition should respond more quickly to both types of questions; 4) Children should be more accurate and have faster reaction times when identifying mood congruent questions (i.e., happy expression while in a happy mood) as opposed to mood incongruent questions (i.e., happy expression while in a sad mood).

Method

Participants

Research assistants (RAs) recruited participants from a database of birth records maintained in our lab and from a local preschool. All parents received a letter via mail or the preschool that described the study. RAs called families recruited from the database to schedule appointments. Data included responses from 139 children aged 5-, 6-, 7-, and 8-years of age.¹ The race/ethnicity of the children was African American ($n = 3$); Caucasian ($n = 97$); Hispanic/Latino/Spanish ($n = 15$); multi-racial or other ($n = 19$); Pacific Islander ($n = 4$); and one family did not report the child's race/ethnicity. Data were collected for an additional 12

children, but were excluded for the following a priori reasons: off-task (child did not follow directions during the experiment; $n = 3$); developmental delays ($n = 3$); chose to stop the study ($n = 4$); and experimenter error (data were not properly saved; $n = 2$). There were 46 children in the neutral and negative mood conditions and 47 children in the positive mood condition. Table 1 contains the age and gender distribution for each mood condition.

Apparatus

Emotion recognition tasks—The facial stimuli for the emotion recognition tasks consisted of 48 digitized, color images of 12 adults (6 female, 6 male), with four images of each adult displaying a different facial expression: happy, sad, surprised, and disgusted. Researchers have commonly relied on adult's facial expressions to assess children's emotion recognition (e.g., De Sonnevile et al., 2002; Gao & Maurer, 2009; Markham & Adams, 1992). The adult images included four African American/Black, four Caucasian, and four Hispanic/Latino/Spanish adults, 10 of which were taken from the NimStim Face Stimulus Set (Tottenham, Borscheid, Ellertsen, Marcus, & Nelson, 2002). Adults reliably rated the facial expressions of all faces in this stimulus set. Due to the limited number of Hispanic/Latino/Spanish adults available in the NimStim Face Stimulus Set, we chose two additional adults from a larger set of facial images. Forty adults (25 females, 15 males) rated the facial expressions (happy, sad, surprised and disgusted) of these images on a 5-point scale (1 = *no sign of the given emotion* and 5 = *exceptionally strong, sustained display*) (Eisenberg et al., 1988; Eisenberg et al., 1998). The two adults chosen had a rating of 3.2 or higher for each of the four facial expressions. Research assistants used Adobe Photoshop to standardize all facial images to be of similar size, brightness/contrast, and background.

For the testing procedure, children answered two types of questions: label-based and context-based. Each question was designed to examine children's recognition of one of four emotions: happy, surprised, sad, or disgusted. For each label-based question, children heard an audio recording of the name of an emotion (e.g., “Sad”) and then heard an audio recording that asked them to identify the face that best matched the label (e.g., “Which face is the sad face?”; Harrigan, 1984; MacDonald et al., 1996). For each context-based question, children heard an audio recording of a vignette. Eight vignettes were adapted from Ribordy, Camras, Stefani, & Spaccarelli (1988).² The vignettes were designed to elicit specific emotions for situations involving a story character (e.g., a story character receives a gift to elicit a happy emotion; a story character's friend moves away to elicit a sad emotion; a story character's dog suddenly begins talking to elicit a surprise emotion; or a story character bites into an apple to find a worm to elicit a disgust emotion). Following each vignette, children heard an audio recording that asked, “Which face best fits my story?” (MacDonald et al., 1996; Ribordy et al., 1988).

Mood induction—To standardize the procedure, a researcher constructed three audio files of a male adult reading the mood induction scripts, one positive, one negative (i.e., stories involving a child that moves to a new town and has a positive or negative experience; both taken from Burkitt & Barnett, 2006), and one neutral (i.e., list of table manners; adapted from Rader & Hughes, 2005). The positive and negative mood induction scripts contained an equal number of emotional descriptors. The neutral mood induction script contained no emotional descriptors. To alleviate children's mood in the negative affect condition, children

¹An initial sample of 87 children's usable data were collected from October, 2007 to October, 2008. To increase sample size and to address reviewers' comments, an additional 52 children's usable data were collected from March, 2012 to September, 2012.

²Names included in the vignettes were changed for each set of faces (e.g., “Johnny” changed to “Juan”). Children from the local preschool received a slightly modified version of one happy context-based vignette to eliminate references to religious holidays. Consequently, the word “Christmas” in one happy context-based question was replaced with “birthday.” A separate analysis demonstrated that these children's accuracy did not significantly vary from other 5-year-olds who heard the original happy vignette.

heard a mood-repair script following the experiment (Burkitt & Barnett, 2006). To examine the effectiveness of the mood induction procedure, children completed a facial affect scale (adapted from Rader & Hughes, 2005). The scale consisted of a set of five schematic faces that expressed emotions ranging from very happy to very sad. Children circled which face best represented how the story made them feel.

Setup and equipment—Participants were tested individually and seated approximately 76 cm away from a Macintosh iBook computer with a 38 cm monitor that displayed the stimulus faces. Audio-recordings played through the computer speakers. The experimenter used SuperLab to display each set of trials, record responses and reaction times, and re-center the mouse cursor position after each click.

Procedure

A trained experimenter obtained consent from the parent and written assent from any child aged 7 years or older. During the assent process, and again before the practice trials began, the experimenter explained to the child that s/he would be asked to identify faces that were happy, sad, surprised, and disgusted. The experimenter confirmed that the child understood what these four emotions meant before continuing the study. If the child did not know what 'disgusted' meant, the word 'yucky' was also provided. The experimenter then introduced the child to the facial affect scale. Similar to previous research (e.g., Rader & Hughes, 2005), children colored in the five faces as the experimenter pointed to each face in a randomized order and provided a label for the emotion being expressed (i.e., very happy, happy, calm, sad, or very sad).

The child and experimenter went into a room separate from the child's parent(s) to complete the study. Parents could observe their child via a television screen while waiting. First, the experimenter provided instructions on how to use the computer and mouse to ensure children were comfortable using the equipment before the study began (children had little to no trouble using the computer mouse). The experimenter then read a brief set of instructions to the participant that detailed what the child would see on the computer screen and how the child should respond to the questions (adapted from Ribordy et al., 1988). Children completed six practice trials (three context-based questions and three label-based questions different from the ones used during testing) by clicking on one of four schematic faces during each trial.

Following the practice trials, the child was randomly assigned to one of three mood conditions (with the constraint that a relatively equal number of children from each age group participated in each mood condition) and listened to the script through the computer speakers.³ Children were instructed to close their eyes and concentrate while they listened to the script and to imagine that the story was about them. The scripts lasted approximately 4 min, a time considered sufficient for sustaining the child's mood for the length of the testing procedure (Bugental & Moore, 1979; Burkitt & Barnett, 2006; Carlson et al., 1983; Masters et al., 1979; Rader & Hughes, 2005; Stegge, Terwogt, & Koops, 1994).

The experimenter again read the task instructions to the participant (adapted from Ribordy et al., 1988) to remind children what they would see and do. There were eight label-based and eight context-based questions created for the experiment. Children were randomly assigned to complete six label-based and six context-based questions to alleviate the length of time they participated in the study. Ordering of question type was counterbalanced across

³All 5-year-old children from the local preschool ($n = 10$) participated in the positive mood condition as requested by the preschool director. A separate analysis demonstrated that these children's responses did not significantly vary from other 5-year-olds in the positive mood condition.

participants with approximately half of the participants receiving the label-based questions first. The type of emotion questions was counterbalanced across participants (i.e., children heard a relatively equal number of happy, sad, surprised, and disgusted label-based and context-based questions). Following each question, four faces of the same individual with different emotional expressions (happy, sad, surprised, and disgusted) were displayed on the screen. Two of the emotional expression photographs were presented horizontally at the top of the screen and two horizontally at the bottom of the screen. The ordering of the faces was randomized for race/ethnicity and sex for each of the trials.

Children identified one emotion per trial. Once the child clicked the mouse on one of the four faces, the study proceeded to the next trial. Data were removed for responses when a child was off-task (e.g., child did not listen to the story for a trial; $n = 13$) or when the child unintentionally clicked the computer mouse ($n = 6$). Following the emotion recognition testing, children completed the facial affect scale. Children in the negative mood condition then heard the mood repair script. The entire procedure lasted approximately 30 min.

Results

Mood Manipulation Check

To determine if we successfully manipulated children's mood, we conducted a one-way ANOVA with mood condition (positive, neutral, and negative) as the between-participants variable and facial affect scale responses regarding how the story made children feel (1 = *very sad* and 5 = *very happy*) as the dependent variable. The analysis indicated that there was a successful manipulation of mood between groups, $F(2, 136) = 41.81, p < .001$. Children in the positive condition ($M = 4.06, SD = 1.26$) and the neutral condition ($M = 4.41, SD = .80$) reported significantly higher positive emotions than those reported by children in the negative condition ($M = 2.24, SD = 1.51$), $ps < .05$. Children in the positive and neutral conditions did not significantly differ, $p > .10$.

Children's Accuracy and Reaction Times

We conducted two separate $2 \times 3 \times 4 \times 4$ (Question Type [label-based, context-based] $\times$ Mood Condition [positive, negative, and neutral] $\times$ Emotional Expression [happy, sad, surprised, disgusted] $\times$ Age [5, 6, 7, and 8-year-olds]) SAS proc mixed analyses with repeated measures to examine children's accuracy and reaction times. Post hoc analyses were conducted using differences in least squares means with Tukey-Kramer adjustments. Least squares means are appropriate to report for unbalanced data (SAS Institute Inc., 2008). Table 2 shows the means and standard deviations for children's accuracy and reaction time for the emotion recognition tasks based on question type and emotional expression.

Accuracy—The dependent variable was percentage of total questions answered correctly. There was a significant main effect for age, $F(3, 135) = 21.47, p < .0001, \omega^2 = .63$, and a main effect for question type, $F(1, 137) = 78.82, p < .0001, \omega^2 = .87$, that were superseded by a significant two-way interaction between age and question type, $F(3, 135) = 6.13, p < .001, \omega^2 = .30$ (see Figure 1). Post hoc analyses revealed no significant differences between the 5-, 6-, 7-, and 8-year-old children's performance on the label-based questions, $ps > .10$. For the context-based questions, 5-year-olds responded less accurately compared to 6-, 7-, and 8-year-olds, $ps < .05$, and 6-year-olds responded less accurately compared to the 7- and 8-year-olds, $ps < .05$. Furthermore, 5-, 6-, and 7-year-olds responded more accurately to the label-based questions compared to the context-based questions, $ps < .01$. For the 8-year-olds, there was no significant difference in performance between the label-based and context-based questions, $p > .10$.

The main effect for emotional expression, $F(3, 135) = 3.80, p < .05, \omega^2 = .19$, was superseded by a significant two-way interaction between question type and emotional expression, $F(3, 132) = 4.80, p < .01, \omega^2 = .24$ (see Figure 2). Post hoc tests revealed no significant differences between children's accuracy on the label-based questions in regard to emotional expressions, $p > .10$. However, for the context-based questions, children were more accurate at the sad and disgusted questions compared to the happy and surprised questions, $ps < .05$. Additionally, children were more accurate at the happy and surprised label-based questions compared to the happy, surprised, and disgusted context-based questions, $ps < .05$. Children were also more accurate at the sad label-based questions compared to the happy, sad, surprised, and disgusted context-based questions, $ps < .05$.

Although a main effect for mood condition did approach significance ($p = .08$), no higher order interactions involving the variable were significant. Additionally, no further higher order interactions involving question type, emotional expression, or age were significant.

Reaction time—The dependent variable was the average length of time (in ms) that it took for children to respond to the questions. Reaction times above or below 2.5 standard deviations from the mean were excluded from the analysis (Hadwin et al., 2003).

There was a main effect for age, $F(3, 135) = 48.35, p < .001, \omega^2 = .80$, and a main effect for mood, $F(2, 135) = 6.76, p < .01, \omega^2 = .34$, that were superseded by a significant two-way interaction between age and mood, $F(6, 132) = 3.56, p < .01, \omega^2 = .18$, (see Figure 3). Post hoc analyses revealed that 5-year-olds in the positive mood condition responded more quickly than 5-year-olds in the neutral and negative mood conditions, $ps < .01$. For the positive mood condition, 5- and 6-year-olds responded more slowly than 7- and 8-year-olds, $ps < .05$. For the neutral mood condition, 5- and 6-year-olds responded more slowly than the 8-year-olds, $ps < .05$. For the negative mood condition, 5-year-olds responded more slowly than the 6-, 7-, and 8-year-olds, $ps < .05$.

There was a main effect for emotional expression, $F(3, 135) = 7.76, p < .01, \omega^2 = .37$, and a main effect for question type, $F(1, 137) = 35.93, p < .001, \omega^2 = .75$, that were superseded by a significant two-way interaction between emotional expression and question type, $F(3, 133) = 2.80, p < .05, \omega^2 = .14$, (see Figure 4). Post hoc tests revealed that for the label-based task, children were faster at completing happy questions compared to surprised questions, $t(133) = 3.32, p < .05$. For the context-based questions, children were faster at completing disgusted questions as compared to the surprised questions, $t(133) = 4.41, p < .01$. Additionally, for the happy, sad, and surprised questions, children were faster at completing label-based compared to the context-based tasks, $ps < .01$. There was no significant difference between children's response times for disgusted questions on the label-based and context-based tasks, $p > .10$. Children were faster at completing happy label-based questions compared to surprised context-based questions, $t(133) = 7.33, p < .01$. Children were faster at completing sad and disgusted label-based questions compared to sad and surprised context-based questions, $ps < .05$.

Although an interaction between children's age and question type was predicted, the interaction was not significant, $p > .10$. Additionally, no further higher order interactions involving question type, emotional expression, or age were significant.

Discussion

As predicted, children were more accurate on the label-based questions as compared to the context-based questions, but this finding applied to the 5-, 6-, and 7-year-olds only. The 8-year-olds showed no differences in accuracy on these tasks. Children were also more

accurate and faster at responding to label-based relative to context-based questions when the emotions were happiness, sadness, or surprise, but showed no differences in accuracy or response time on the two tasks when the emotion was disgust. The 7- and 8-year-olds also responded more accurately than the 6-year-olds who responded more accurately than the 5-year-olds, but these age differences applied only to the context-based questions. There were no age differences in accuracy for the label-based questions. Regardless of question type, the 7- and 8-year-olds generally showed faster response times than the 5- and 6-year-olds. These findings demonstrate, like past research, that the age of the child is an important predictor of performance on emotion recognition tasks, but add to the literature by showing that the type of task and emotional expression being tested can differentially impact children's accuracy and response times at various ages.

Positive mood did facilitate reaction times for both types of questions as hypothesized, but only for the 5-year-olds; they were faster at responding to questions when they were in a positive mood compared to when they were in a neutral or negative mood. Inconsistent with our predictions, children were not more accurate or faster at responding to mood congruent questions. Although mood had a limited influence on children's responses, our findings show that positive mood can enhance young children's speed of processing in an emotion recognition task, regardless of whether mood matches the valence of the emotion being identified. This finding replicates previous research with label-based tasks (Carlson et al., 1983), but extends it to context-based tasks, a paradigm that may be more ecologically valid.

Children's Age and Question Type

Children's age interacted with question type to influence accuracy. Five-, 6-, and 7-year-olds performed more accurately on the label-based tasks compared to the context-based tasks. Furthermore, the 7- and 8-year-olds were more accurate on the context-based tasks compared to the 6-year-olds, who were more accurate than the 5-year-olds. Despite our prediction, children's age did not interact with question type to influence reaction time.

Possible reasons for these findings may be due to the difference in task complexity between the label-based and context-based questions. Inferring an emotion from context is more cognitively complex than matching an emotional expression to a discrete label (MacDonald et al., 1996). Inferring emotional expressions requires knowledge about emotional expression labels (Bennett, Bendersky, & Lewis, 2005), what emotional expressions look like (Ekman, 1992, 1993), and factors that might influence emotions (Carroll & Russell, 1996; Gross & Ballif, 1991). Label-based tasks, on the other hand, do not require a consideration of factors that might influence a person's emotion. The additional cognitive skills needed for context-based tasks as compared to label-based tasks clearly affected 5-, 6-, and 7-year-olds' emotion recognition accuracy.

For the 8-year-old children, however, context-based questions were not more difficult than the label-based questions; children performed equally well on each type of task. Possible reasons for these findings are developmental differences in children's emotional knowledge, inferential abilities, and memory (recall vs. recognition). Increases in social experiences as children mature can lead to increases in emotion knowledge. As a result, children's competence in emotion recognition and understanding of how situational cues may affect others' emotions will improve (Bennett et al., 2005; Carroll & Russell, 1996; Denham & Couchoud, 1990; Gross & Ballif, 1991; Michalson & Lewis, 1985). Children's ability to make accurate inferences concerning others' emotions also improves with age, especially through childhood (Denham, 1986). Furthermore, tasks involving recall memory require greater processing capacity than tasks involving recognition memory (Whiting & Smith, 1997). Compared to younger children, older children's greater accuracy on a more cognitively complex task (i.e., context-based task) suggests a better ability for them to recall

and apply emotion situation knowledge (Brody & Harrison, 1987; Denham & Couchoud, 1990).

Emotional Expression and Question Type

Although children were equally accurate in identifying emotions in the label-based questions, they were most accurate in identifying sad and disgusted emotions in the context-based questions. Additionally, children were faster at completing the happy, sad, and surprised label-based questions compared to the context-based questions. This study demonstrated that when children are required to use contextual information, they may be more accurate in the identification of certain emotions (e.g., sadness and disgust) compared to that of other emotions (e.g., happiness and surprise). One explanation for this result is that negative events may be more easily remembered than positive events (Ochsner, 2000). The recollection of specific details (e.g., what a person's face may have looked like) may also be more accurate for negative events compared to positive events (Kensinger, 2007). Hearing vignettes about negative situations (e.g., having a friend move away or biting into an apple to find a worm) may therefore enhance memory recall to a greater extent than hearing positive vignettes (e.g., receiving a present or having their dog suddenly start speaking), thereby increasing children's accuracy for emotional expressions that match negative events (Carroll & Russell, 1996; Gross & Ballif, 1991; Kensinger, 2007; Storbeck & Clore, 2005).

When children needed to infer an emotional label for happy, sad, or surprised expressions, it increased their reaction time compared to when the emotional label was provided. This result is not surprising given that recall tasks generally result in longer latencies compared to recognition tasks (Whiting & Smith, 1997). Compared to label-based tasks, context-based tasks may delay children's responding for certain emotions (e.g., sad), but it may not necessarily hinder their accuracy in identifying that emotion.

It is interesting that for the disgust emotion, there was no significant difference in children's accuracy or reaction time for label-based compared to context-based questions. One explanation for this result may be that children generally have trouble with labeling the emotion of disgust (Camras & Allison, 1985), associating a face to the expression (Widen & Russell, 2003), and imagining potential causes for the emotion (Widen & Russell, 2004). Compared to the other expressions, providing a label for disgust is therefore unlikely to facilitate children's accuracy or response time relative to providing contextual information.

Children's Mood and Age

Mood had a substantial influence on how quickly young children responded to the questions. Five-year-olds in the positive mood condition completed the label-based and context-based questions significantly faster than 5-year-olds in the neutral and negative mood conditions. Other studies have shown that positive mood enhances both children and adults' cognitive performance (e.g., Baumann & Kuhl, 2005; Bryan et al., 1996; Goeleven, De Raedt, & Koster, 2007; Kitzan, 2001; Masters et al., 1979; Rader & Hughes, 2005), but this is one of only two studies to show that mood also enhances children's speed of processing for an emotion recognition task. This finding corroborates research demonstrating that positive mood facilitates young children's (i.e., 4-year-olds) response rates when matching peers' emotions to a label (Carlson et al., 1983), but it adds to the literature by demonstrating that the influence of positive affect extends to context-based emotion recognition tasks and recognition of adults' emotions.

Regardless of mood condition, 5-year-olds generally responded more slowly than the older children. When in a negative mood, 5-year-olds were significantly slower at completing the label-based and context-based questions compared to the other children (i.e., 6-, 7-, and 8-

year-olds). When in a positive and neutral mood, however, the 5-year-olds' response rates were similar to that of the 6-year-olds' (see Figure 3). It appears that for the youngest children, positive mood is especially advantageous (i.e., decreases their response time), but negative mood is particularly disadvantageous (i.e., hinders their response time). Negative mood may not have hampered 6-, 7-, and 8-year-olds' response times because their emotion recognition abilities are more advanced compared to younger children (Gross & Ballif, 1991). Our findings suggest children's mood is most likely to impact their emotion processing before reaching middle childhood.

Children's Mood and Emotion Recognition Accuracy

Contrary to our prediction that children would be more accurate and respond more quickly when identifying mood congruent relative to mood incongruent questions, mood did not interact with emotional expression in the label-based or context-based tasks. Our results replicate Carlson et al.'s (1983) finding that children's emotion recognition accuracy did not differ across the mood induction conditions. Adults' emotion recognition accuracy, however, is influenced by mood. When adults identify a facial expression that matches the valence of their mood, accuracy improves. For example, adults in a positive mood more accurately identify happy expressions relative to sad expressions, whereas adults in a negative mood more accurately identify sad expressions relative to happy expressions (Schmid & Mast, 2010). Adults in the Schmid and Mast study indicated only whether the expression was happy or sad, whereas children in the present study chose from one of four emotional expressions. It is therefore unclear whether the differences are due to methodology or development, but age of the children is likely an important consideration. Mood congruency is an effect that is typically stronger for older children (e.g., 10-11-year-old children) compared to younger children (e.g., 6-7-year-olds) (Stegge, Terwogt, & Koops, 1995). An ability to more accurately and readily identify emotions that are consistent with one's own emotional state may be a skill that is molded and refined with age. Future research should use the same tasks to examine any developmental changes in the influence of mood on children, adolescents, and adults' emotion recognition accuracy.

Limitations

There are a few limitations to the present study that should be considered. Because participants indicated their responses using a computer mouse, age differences in reaction times may be due to older children being more proficient with using the mouse and possessing better motor skills than younger children. Although experimenters examined children's effectiveness in using the mouse at the start of the study (which included the use of practice trials), the use of verbal response measures, along with an assessment of verbal ability (e.g., Brown & Dunn, 1996), in future experiments could eliminate this concern. The age differences found in our study, however, corroborate previous research (Boyatzis et al., 1993; Camras & Allison, 1985; MacDonald et al., 1996), suggesting age findings were likely not due to the method.

Another concern is that children in the neutral mood condition reported a similar level of positive affect as children in the positive mood condition. The neutral mood story was not intended to alter children's emotional state. Children in the neutral mood condition, however, may have been aroused due to the attention they received or the excitement and enjoyment they experienced from participating in the study and being in a novel environment. It is possible that children may have overestimated their level of affect (especially in the neutral condition). When interviewed at the end of the experiment, children may have reported their general state of emotional arousal rather than how the story made them feel. Despite reporting a mood similar to those in the positive mood condition, children in the neutral mood condition showed reaction times more similar to those in the

negative mood condition (see Figure 3), suggesting important differences between the positive and neutral mood conditions.

Finally, we did not assess children's mood before they heard the mood inducing scripts. The purpose of assessing children's mood only after hearing the scripts and completing the tasks was to help prevent children from guessing the objective of the experiment, a technique researchers use when experimentally manipulating children's mood (e.g., Bryan et al., 1996; Burkitt & Barnett, 2006; Masters et al., 1979; Stegge et al., 1994). In future experiments, however, researchers may want to consider assessing mood before and after the mood induction procedure to directly assess changes in affect.

Conclusions

Findings from the present study add to the existing literature by demonstrating that when children are required to use contextual information, they are more accurate at inferring sad and disgusted emotions compared to happy and surprised emotional expressions. Future research should assess whether these findings apply to other negative emotions as well. Results extended the finding that positive affect (as compared to negative affect) facilitates young children's processing of others' emotional expressions beyond label-based tasks to tasks requiring emotion inference (context-based tasks), which may be more ecologically valid. Future studies should manipulate both mood and contextual information in social information processing scenarios to examine the influence of these factors on children's emotion recognition and decision making. Additionally, future studies should investigate specific age ranges to help determine the developmental course for the effects of mood congruency and positive affect. Discovering how children interpret the emotional meaning of others' facial expressions provides information for how children infer the motives and intentions of others within social interactions, a skill that aides in the formation and maintenance of successful social relationships (Dwyer et al., 2010).

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References

- Ashby F, Isen AM, Turken AU. A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review*. 1999; 106(3):529–550. doi:10.1037/0033-295X.106.3.529. [PubMed: 10467897]
- Baas M, De Dreu CW, Nijstad BA. A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus?. *Psychological Bulletin*. 2008; 134(6):779–806. doi:10.1037/a0012815. [PubMed: 18954157]
- Batty M, Taylor M. The development of emotional face processing during childhood. *Developmental Science*. 2006; 9(2):207–220. doi:10.1111/j.1467-7687.2006.00480.x. [PubMed: 16472321]
- Baumann N, Kuhl J. Positive affect and flexibility: overcoming the precedence of global over local processing of visual information. *Motivation and Emotion*. 2005; 29(2):123–134. doi:10.1007/s11031-005-7957-1.
- Bennett D, Bendersky M, Lewis M. Antecedents of emotion knowledge: Predictors of individual differences in young children. *Cognition and Emotion*. 2005; 19(3):375–396. doi: 10.1080/02699930441000201. [PubMed: 16894396]
- Bower GH. Mood and memory. *American Psychologist*. 1981; 36(2):129–148. doi: 10.1037/0003-066X.36.2.129. [PubMed: 7224324]

- Boyatzis C, Chazan E, Ting C. Preschool children's decoding of facial emotions. *Journal of Genetic Psychology*. 1993; 154(3):375–382. [PubMed: 8245911]
- Brody LR, Harrison RH. Developmental changes in children's abilities to match and label emotionally laden situations. *Motivation And Emotion*. 1987; 11(4):347–365. doi:10.1007/BF00992849.
- Brown JR, Dunn J. Continuities in emotion understanding from 3–6 yrs. *Child Development*. 1996; 67(3):789–802. doi:10.2307/1131861. [PubMed: 8706526]
- Bryan T, Mathur S, Sullivan K. The impact of positive mood on learning. *Learning Disability Quarterly*. 1996; 19(3):153–162. doi:10.2307/1511058.
- Bugental D, Moore B. Effects of induced moods on voice affect. *Developmental Psychology*. 1979; 15(6):664–665. doi:10.1037/0012-1649.15.6.664.
- Bullock M, Russell J. Preschool children's interpretation of facial expressions of emotion. *International Journal of Behavioral Development*. 1984; 7(2):193–214. doi:10.1016/S0163-6383(84)80255-6.
- Burkitt E, Barnett N. The effects of brief and elaborate mood induction procedures on the size of young children's drawings. *Educational Psychology*. 2006; 26(1):93–108. doi:10.1080/01443410500341049.
- Camras L, Allison K. Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior*. 1985; 9(2):84–94. doi:10.1007/BF00987140.
- Carlson C, Felleman E, Masters J. Influence of children's emotional states on the recognition of emotion in peers and social motives to change another's emotional state. *Motivation and Emotion*. 1983; 7(1):61–79. doi:10.1007/BF00992965.
- Carroll J, Russell J. Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology*. 1996; 70(2):205–218. doi:10.1037/0022-3514.70.2.205. [PubMed: 8636880]
- Chung M, Thomson D. Development of face recognition. *British Journal of Psychology*. 1995; 86(1):55–87. [PubMed: 7712070]
- Crick N, Dodge K. A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*. 1994; 115(1):74–101. doi:10.1037/0033-2909.115.1.74.
- De Dreu CW, Baas M, Nijstad BA. Hedonic tone and activation level in the mood-creativity link: Toward a dual pathway to creativity model. *Journal Of Personality And Social Psychology*. 2008; 94(5):739–756. doi:10.1037/0022-3514.94.5.739. [PubMed: 18444736]
- Denham SA. Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation. *Child Development*. 1986; 57(1):194–201. doi:10.2307/1130651.
- Denham, SA. Social and emotional prevention and intervention programming for preschoolers. Kluwer Academic/Plenum; New York: 2003.
- Denham SA, Couchoud EA. Young preschoolers' understanding of emotions. *Child Study Journal*. 1990; 20:171–192.
- De Sonnevile LJ, Vershoor CA, Njiokiktjien CC, Veld V, Toorenaar NN, Vranken MM. Facial identity and facial emotions: Speed, accuracy and processing strategies in children and adults. *Journal of Clinical and Experimental Neuropsychology*. 2002; 24(2):200–213. doi:10.1076/jcen.24.2.200.989. [PubMed: 11992203]
- Dwyer K, Fredstrom B, Rubin K, Booth-LaForce C, Rose-Krasnor L, Burgess K. Attachment, social information processing, and friendship quality of early adolescent girls and boys. *Journal of Social and Personal Relationships*. 2010; 27(1):91–116. doi:10.1177/0265407509346420.
- Eisenberg N, Fabes R, Bustamante D, Mathy R, Miller P, Lindholm E. Differentiation of vicariously induced emotional reactions in children. *Developmental Psychology*. 1988; 24(2):237–246. doi:10.1037/0012-1649.24.2.237.
- Eisenberg N, Schaller M, Fabes RA, Bustamante D, Mathy RM, Shell R, Rhodes K. Differentiation of personal distress and sympathy in children and adults. *Developmental Psychology*. 1998; 24(6):766–775.
- Ekman P. Facial expressions of emotion: New findings, new questions. *Psychological Science*. 1992; 3(1):34–38. doi:10.1111/j.1467-9280.1992.tb00253.x.
- Ekman P. Facial expression and emotion. *American Psychologist*. 1993; 48(4):384–392. doi:10.1037/0003-066X.48.4.384. [PubMed: 8512154]

- Elfenbein H, Ambady N. On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*. 2002b; 128(2):203–235. doi:10.1037/0033-2909.128.2.203. [PubMed: 11931516]
- Ellis HC, Thomas RL, Rodriguez IA. Emotional mood states and memory: Elaborative encoding, semantics processing, and cognitive effort. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 1984; 10(3):470–482. doi:10.1037/0278-7393.10.3.470.
- Felleman E, Carlson C, Barden R, Rosenberg L, Masters J. Children's and adults' recognition of spontaneous and posed emotional expressions in young children. *Developmental Psychology*. 1983; 19(3):405–413. doi:10.1037/0012-1649.19.3.405.
- Forgas, JP. Affect and information processing strategies: An interactive relationship.. In: Forgas, JP., editor. *Feeling and thinking: The role of affect in social cognition*. Cambridge University Press; New York, NY US: 2000. p. 253-280.
- Forgas JP. Mood effects on person-perception judgments. *Journal of Personality and Social Psychology*. 1987; 53(1):53–60. Doi: 10.1037/0022-3514.53.1.53. [PubMed: 3612493]
- Gao X, Maurer D. Influence of intensity on children's sensitivity to happy, sad, and fearful facial expressions. *Journal of Experimental Child Psychology*. 2009; 102(4):503–521. doi:10.1016/j.jecp.2008.11.002. [PubMed: 19124135]
- Gnepp J. Children's social sensitivity: Inferring emotions from conflicting cues. *Developmental Psychology*. 1983; 19(6):805–814. doi:10.1037/0012-1649.19.6.805.
- Gnepp J, Gould M. The development of personalized inferences: Understanding other people's emotional reactions in light of their prior experiences. *Child Development*. 1985; 56(6):1455–1464. doi:10.2307/1130465. [PubMed: 4075868]
- Goeleven E, De Raedt R, Koster E. The influence of induced mood on the inhibition of emotional information. *Motivation and Emotion*. 2007; 31(3):208–218. doi:10.1007/s11031-007-9064-y.
- Gross A, Ballif B. Children's understanding of emotion from facial expressions and situations: A review. *Developmental Review*. 1991; 11(4):368–398. doi:10.1016/0273-2297(91)90019-K.
- Hadwin J, Donnelly N, French C, Richards A, Watts A, Daley D. The influence of children's self-report trait anxiety and depression on visual search for emotional faces. *Journal of Child Psychology and Psychiatry*. 2003; 44(3):432–444. doi:10.1111/1469-7610.00133. [PubMed: 12635972]
- Harrigan JA. The effects of task order on children's identification of facial expressions. *Motivation and Emotion*. 1984; 8(2):157–169. doi:10.1007/BF00993071.
- Herr PM, Page CM, Pfeiffer BE, Davis DF. Affect influences on evaluative processing. *Journal of Consumer Research*. 2012; 38(5):833–845.
- Isen AM. Missing in action in the AIM: Positive affect's facilitation of cognitive flexibility, innovation, and problem solving. *Psychological Inquiry*. 2002; 13(1):57–65.
- Isen AM, Daubman KA. The influence of affect on categorization. *Journal of Personality and Social Psychology*. 1984; 47(6):1206–1217. doi:10.1037/0022-3514.47.6.1206.
- Isen AM, Daubman KA, Nowicki GP. Positive affect facilitates creative problem solving. *Journal Of Personality And Social Psychology*. 1987; 52(6):1122–1131. doi:10.1037/0022-3514.52.6.1122. [PubMed: 3598858]
- Kaufmann G, Vosburg SK. 'Paradoxical' mood effects on creative problem-solving. *Cognition And Emotion*. 1997; 11(2):151–170. doi:10.1080/026999397379971.
- Kensinger E. Negative emotion enhances memory accuracy: Behavioral and neuroimaging evidence. *Current Directions in Psychological Science*. 2007; 16(4):213–218. doi:10.1111/j.1467-8721.2007.00506.x.
- Kitzan L. Effects of induced mood on cognitive processing in healthy older and younger adults. *Dissertation Abstract International: Section B: The Sciences and Engineering*. 2001; 62(4):2062.
- Leight KA, Ellis HC. Emotional mood states, strategies, and state-dependency in memory. *Journal of Verbal Learning & Verbal Behavior*. 1981; 20(3):251–266. doi:10.1016/S0022-5371(81)90406-0.
- Lemerise E, Arsenio W. An integrated model of emotion processes and cognition in social information processing. *Child Development*. 2000; 71(1):107–118. doi:10.1111/1467-8624.00124. [PubMed: 10836564]

- MacDonald P, Kirkpatrick S, Sullivan L. Schematic drawings of facial expressions for emotion recognition and interpretation by preschool-aged children. *Genetic, Social, and General Psychology Monographs*. 1996; 122(4)
- Mackie DM, Worth LT. Processing deficits and the mediation of positive affect in persuasion. *Journal Of Personality And Social Psychology*. 1989; 57(1):27–40. doi:10.1037/0022-3514.57.1.27. [PubMed: 2754602]
- Markham R, Adams K. The effect of type of task on children's identification of facial expressions. *Journal of Nonverbal Behavior*. 1992; 16(1):21–39. doi:10.1007/BF00986877.
- Masters J, Barden R, Ford M. Affective states, expressive behavior, and learning in children. *Journal of Personality and Social Psychology*. 1979; 37(3):380–390. doi:10.1037/0022-3514.37.3.380.
- Michalson, L.; Lewis, M. What do children know about emotions and when do they know it?. In: Lewis, M.; Saarni, C., editors. *The socialization of emotions*. Plenum; New York: 1985. p. 117-140.
- Mondloch C, Geldart S, Maurer D, Le Grand R. Developmental changes in face processing skills. *Journal of Experimental Child Psychology*. 2003; 86(1):67–84. doi:10.1016/S0022-0965(03)00102-4. [PubMed: 12943617]
- Morgan JK, Izard CE, King KA. Construct validity of the Emotion Matching Task: Preliminary evidence for convergent and criterion validity of a new emotion knowledge measure for young children. *Social Development*. 2010; 19(1):52–70. doi:10.1111/j.1467-9507.2008.00529.x. [PubMed: 20376197]
- Murray H. The effect of fear upon estimates of the maliciousness of other personalities. *The Journal of Social Psychology*. 1933; 4:310–329.
- Niedenthal PM, Halberstadt JB, Setterlund MB. Being happy and seeing 'happy': Emotional state mediates visual word recognition. *Cognition And Emotion*. 1997; 11(4):403–432.
- Ochsner KN. Are affective events richly recollected or simply familiar? The experience and process of recognizing feelings past. *Journal Of Experimental Psychology: General*. 2000; 129(2):242–261. doi:10.1037/0096-3445.129.2.242. [PubMed: 10868336]
- Potts R, Morse M, Felleman E, Masters JC. Children's emotions and memory for affective narrative content. *Motivation and Emotion*. 1986; 10(1):39–57. doi:10.1007/BF00992149.
- Rader N, Hughes E. The influence of affective state on the performance of a block design task in 6- and 7-year-old children. *Cognition and Emotion*. 2005; 19(1):143–150. doi:10.1080/02699930441000049.
- Ribordy SC, Camras LA, Stefani R, Spaccarelli S. Vignettes of emotion recognition research and affective therapy with children. *Journal of Child Clinical Psychology*. 1988; 17:322–325.
- Saarni, C. Nebraska Symposium on Motivation, 1988: Socioemotional development. University of Nebraska Press; Lincoln, NE US: 1990. Emotional competence: How emotions and relationships become integrated.; p. 115-182.
- Saarni, C.; Campos, J.; Camras, L.; Witherington, D. *Handbook of child psychology: Vol. 3, Social, emotional, and personality development*. 6th ed.. John Wiley & Sons Inc.; Hoboken, NJ US: 2006. Emotional Development: Action, Communication, and Understanding.; p. 226-299.
- SAS Institute Inc.. *SAS/STAT® 9.2 User's Guide*. SAS Institute Inc.; Cary, NC: 2008.
- Schmid P, Mast M. Mood effects on emotion recognition. *Motivation and Emotion*. 2010; 34(3):288–292. doi:10.1007/s11031-010-9170-0.
- Schultheiss O, Pang J, Torges C, Wirth M, Treynor W. Perceived facial expressions of emotion as motivational incentives: Evidence from a differential implicit learning paradigm. *Emotion*. 2005; 5(1):41–54. doi:10.1037/1528-3542.5.1.41. [PubMed: 15755218]
- Stegge H, Terwogt M, Koops W. Positive and negative mood effects in children: The mediating influence of task characteristics. *Journal of General Psychology*. 1994; 121(4):333–344. [PubMed: 7815048]
- Stegge H, Terwogt M, Koops W. Mood congruity in children: Effects of age, imagery capability, and demand characteristics. *International Journal of Behavioral Development*. 1995; 18(1):177–191.
- Storbeck J, Clore GL. With Sadness Conies Accuracy; With Happiness, False Memory: Mood and the False Memory Effect. *Psychological Science*. 2005; 16(10):785–791. doi:10.1111/j.1467-9280.2005.01615.x. doi:10.1111/j.1469-7610.1986.tb01838.x. [PubMed: 16181441]

- Thompson RA. Development of children's inferences of the emotions of others. *Developmental Psychology*. 1987; 23(1):124–131. doi:10.1037/0012-1649.23.1.124.
- Tonks J, Williams W, Frampton I, Yates P, Slater A. Assessing emotion recognition in 9-15-years olds: Preliminary analysis of abilities in reading emotion from faces, voices and eyes. *Brain Injury*. 2007; 21(6):623–629. doi:10.1080/02699050701426865. [PubMed: 17577713]
- Tottenham N, Borscheid A, Ellertsen K, Marcus DJ, Nelson CA. Categorization of facial expressions in children and adults: Establishing a larger stimulus set. *Journal of Cognitive Neuroscience*. 2002; 14
- Turkstra L. Should my shirt be tucked in or left out? The communication context of adolescence. *Aphasiology*. 2000; 14(4):349–364. doi:10.1080/026870300401405.
- Whiting W, Smith A. Differential age-related processing limitations in recall and recognition tasks. *Psychology and Aging*. 1997; 12(2):216–224. doi:10.1037/0882-7974.12.2.216. [PubMed: 9189981]
- Widen SC, Russell JA. A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology*. 2003; 39(1):114–128. doi:10.1037/0012-1649.39.1.114. [PubMed: 12518813]
- Widen SC, Russell JA. The relative power of an emotion's facial expression, label, and behavioral consequence to evoke preschoolers' knowledge of its cause. *Cognitive Development*. 2004; 19(1): 111–125. doi:10.1016/j.cogdev.2003.11.004.

Figure 1.
Mean accuracy rates and standard deviation for children's emotion recognition accuracy based on age and question type.

Figure 2.
Mean accuracy rates and standard deviation for children's emotion recognition based on question type and emotional expression.

Figure 3. Mean reaction times and standard deviation for children's emotion recognition based on children's mood condition and age.

Figure 4. Mean reaction times and standard deviation for children's emotion recognition based on question type and emotional expression.

Table 1

Number of Participants: Gender and Age Distribution for Children in the Positive, Neutral and Negative Mood Conditions

Gender	5-year-olds		6-year-olds		7-year-olds		8-year-olds		Total
	Females	Males	Females	Males	Females	Males	Females	Males	N
Positive	8	7	6	5	6	5	4	6	47
Neutral	8	7	5	8	6	5	4	3	46
Negative	7	5	4	8	7	7	6	2	46
Total	23	19	15	21	19	17	14	11	139

Means and Standard Deviation for Children's Accuracy and Reaction Time for the Emotion Recognition Tasks Based on Question Type and Emotional Expression

Table 2

Accuracy (% correct)					
Label-Based			Context-Based		
Condition	Mean	SD	Incorrect	Mean	SD
Happy	.93	.26	16/223	.71	.46
Sad	.94	.23	12/194	.82	.39
Surprised	.94	.24	13/206	.69	.46
Disgusted	.90	.30	21/204	.83	.37

Reaction Time (in ms)					
Label-Based			Context-Based		
Condition	Mean	SD	Mean	SD	
Happy	3875.30	2140.02	5149.33	3020.84	
Sad	4501.68	2552.55	5485.38	3282.21	
Surprised	4740.13	3151.14	6069.29	4288.34	
Disgusted	4519.33	2688.58	4697.42	2470.89	